

# Ionic Regulation and Toxicity: Literature Update

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Water Quality Branch

8/22/12 Draft

# Disclaimer

- Information presented for ESA consultation discussion purposes only
- Data presented has not been determined to be suitable for WQ criteria development by USEPA
  - Chloride criteria review is underway in HECD (HQ)
  - Sulfate criteria review may be FY13 priority
- Data is being presented to allow us to identify “best available data” per ESA regulations and to help identify defensible effect levels for listed species

# Chloride Literature Update

- Glochidia (acute)
  - Pandolfo 2012 “Acute effects of road salts and associated cyanide compounds on the early life stages of the unionid mussel *Villosa iris*” ETC 31(8):1801-1806
  - Gillis 2011 “Assessing the toxicity of sodium chloride to the glochidia of freshwater mussels: Implications of salinization of surface waters” Environmental Pollution 159:1702-1708
  - Cope 2008
  - Valenti 2007
  - Bringolf 2007 “Acute and chronic toxicity of technical grade pesticides to glochidia and juveniles of freshwater mussels (Unionidae)” ETC 26(10):2086-2093
- Juvenile Mussels (acute)
  - Pandolfo 2012
- Other Species (acute and chronic for 9 species)
  - Elphick 2011 “Chronic toxicity of chloride to freshwater species: effects of hardness and implications for water quality guidelines” ETC 30(1):239-246

# Sulfate Literature Update

- Juvenile Mussels (Acute)
  - Soucek 2009 – Report to USEPA Region 5
  - Ingersoll 2011 - Report to USEPA Region 5
- Acute and Chronic (1 mussel, 3 other species)
  - Ingersoll 2011 - Report to USEPA Region 5
- Chronic data for 7 species at different hardness
  - Elphick 2011 “An aquatic toxicological evalution of sulfate: the case for considering hardness as a modifying factor in setting water quality guidelines”  
ETC 30(1):247-253

# Ionic Regulation and Toxicity: ICE Model Results

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# Listed Aquatic Species Taxonomy

Status	Species	State(s)	Family	Tribe
E	<a href="#">Catspaw, white (<i>Epioblasma obliquata peroobliqua</i>)</a>	IN, OH	Unionidae	Lampsilini
E	<a href="#">Fanshell (<i>Cyprogenia stegaria</i>)</a>	IL, IN, OH	Unionidae	Lampsilini
E	<a href="#">Higgins eye (<i>Lampsilis higginsii</i>)</a>	IL, WI, MI	Unionidae	Lampsilini
E	<a href="#">Mucket, pink (pearlymussel) (<i>Lampsilis abrupta</i>)</a>	IL, IN, OH	Unionidae	Lampsilini
E	<a href="#">Purple cat's paw (<i>Epioblasma obliquata obliquata</i>)</a>	OH	Unionidae	Lampsilini
E	Rayed bean ( <i>Villosa fabalis</i> )	IN, OH, MI	Unionidae	Lampsilini
E	<a href="#">Riffleshell, northern (<i>Epioblasma torulosa rangiana</i>)</a>	IN, OH, MI	Unionidae	Lampsilini
E	Snuffbox mussel ( <i>Epioblasma triquetra</i> )	MN, WI, OH, IN, MI, IL	Unionidae	Lampsilini
E	<a href="#">Clubshell (<i>Pleurobema clava</i>)</a>	IN, OH, MI	Unionidae	Pleuroblemini
E	<a href="#">Pigtoe, rough (<i>Pleurobema plenum</i>)</a>	IN	Unionidae	Pleuroblemini
E	<a href="#">Pimpleback, orangefoot (<i>Plethobasus cooperianus</i>)</a>	IL, IN	Unionidae	Pleuroblemini
E	<a href="#">Wartyback, white (<i>Plethobasus cicatricosus</i>)</a>	IN	Unionidae	Pleuroblemini
E	<a href="#">Mapleleaf, winged (<i>Quadrula fragosa</i>)</a>	WI, MN	Unionidae	Quadrulini
E	Spectaclecase ( <i>Cumberlandia monodonta</i> )	IL, IN, OH, WI	Margaritiferidae	Unknown

# Chloride and Sulfate Toxicity:

## Mussel ICE model results

Chemical	Species X	Species	Species Y	R2	p.value	df	MSE	Bootstrap.succes	taxonomic.distiance	predicted	dlower ci.	upper ci.	Acute ECA ci/predicted	(lower c.i. divided by 2.27)	
Sulfate	Fatmucket	Lampsilis siliquoidea)	Lampsilis	0.99	20792.36E-05	4	0.038825	100	1	4702	2728.1	8105	1.72	1202	
Sulfate	Fatmucket	Lampsilis siliquoidea)	Unionidae	0.98	96383.73E-06	5	0.057422	100	2	5454	3176.5	9364	1.72	1399	
	Species X	Species Name	Species Y	R2	p.value	df	MSE	Bootstrap.succes	taxonomic.distiance	predicted	dlower ci.	upper ci.	Acute ECA ci/predicted	(lower c.i. divided by 2.27)	
Chloride	Fatmucket	Lampsilis siliquoidea)	Lampsilis	0.99	20792.36E-05	4	0.038825	100	1	4042	2359	6927		1039 740.2	
Chloride I	Rainbow musse	(Villosa iris)	Lampsilis	0.99	0.00098	8	1	2.34E-05		2	3007	2750.8	3288		1212 863.1
Chloride I	Rainbow musse	(Villosa iris)	Unionidae	0.99	0.00123	6	1	3.74E-05		2	3072	2758.2	3438		1215 865.4

See also Excel Spreadsheet

# Putting it all together

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# Pieces of Information

- Species Range maps (IL example)
- NPDES dischargers
- Background concentrations
- Range of Criteria values
- Effect levels from ICE and toxicity studies